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PATENT SPECIFICATION



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489,316

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Complete Specification Accepted: July 25, 1938.

COMPLETE SPECIFICATION

Improvements in or relating to Devices for use in Surgery

We, DAVIS & GECK, INC., a corporation organised under the Laws of the State of New York, United States of America, of 217, Duffield Street, Brooklyn, New York, United States of America, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to devices for use in surgery, and to methods of producing such devices.

As long ago as 1774, Leconte advocated wrapping a section of a goose quill around a wounded blood vessel holding it in place with a ligature. Later Latteri and Petrinari reported the use of implanted magnesium tubes and quills of doves' feathers for end to end anastomosis of the severed common bile duct using such tubes and quills. Today the use of Murphy buttons for end to end anastomosis of the severed or strictured intestinal tract is well known. Difficulties are encountered in these situations in that after the parts have healed, the non-absorbable tubes, or buttons must be removed, accomplished usually by dislodgment and subsequent passage out of the system by the patient.

The principal object of the invention is to avoid the necessity of removal of such tubes, and with this end in view, the invention provides a sterile tube constructed artificially from absorbable animal tissue which is readily absorbed or digested by the body during or subsequent to the repair period. The term "constructed artificially" used here and in the appended claims means, for the present purpose that the tube is made up from material in strip, cord or pulp form which is wound, wrapped, braided, moulded or otherwise formed into a tube, and does not mean that the tube is a naturally occurring tube artificially treated to modify its character while retaining its tubular form. The tube of this invention may be made straight, angular, curved, Y-shaped or T-shaped, and may be of such absorbable animal

tissue as the submucosa layer of animal intestinal tissue. 55

The invention further contemplates a method of making the improved tube of absorbable animal tissue. This may be done by wrapping, winding, spinning or forming the tissue over a mandrel or core, form pressing the tissue to shape and subsequently removing the core. For this purpose, the animal tissue may be in the form of threads, ribbons or a pulp to which a binder such as glue has been added so that upon formation of the material into a tube, the material will harden in that shape and maintain its form. 60 65

It has been proposed to make flexible tubes intended to convey petrol, oil and the like by winding successive layers of intestinal membrane or skin spirally upon a former, the tubing being reinforced if desired by the introduction between the layers of an extensibly woven or otherwise suitably prepared or cut fabric. 70 75

It has also been proposed to use gelatine in the production of tubes for medical purposes e.g. for catheters, drainage tubes etc. by applying successive coatings of a gelatine mix to a mandrel, by moulding the product in a pasty condition or by winding on to a mandrel a continuous bond. 80 85

Perhaps the uses to which the tubes of this character may be put may be readily separated into five types of situations, as follows:

1. End to end, end to side, or side to side anastomosis;
2. Transplantation of one duct into another;
3. Structural support for reconstruction or repair;
4. Used as an exterior sheath to protect a transplanted nerve, tendon or the like;
5. Used for drainage purposes, with or without wicks. 90 100

The invention further consists in the novel construction, arrangement and combination of parts and methods of manufacture more fully hereinafter described with reference to the drawings: 105

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- In the drawings:
 Figure 1 shows a complete tube of this invention;
 Figure 2 shows a modified form of tube
 5 with depressions in its end portions;
 Figure 3 shows a collared bobbin;
 Figure 4 is a modified bobbin or tube
 with collars at each end;
 Figure 5 shows a spool-shaped tube or
 10 bobbin;
 Figure 6 illustrates a di-conical shaped
 tube;
 Figure 7 shows a completed Y-tube;
 Figure 7a illustrates a completed
 15 T-tube;
 Figure 8 shows the method of wrapping
 tapes on a mandrel in the manufacture
 of a tube prior to form pressing
 where that is desirable;
 20 Figure 9 shows a tube in the process of
 being formed from cords;
 Figure 10 shows a tube in the process of
 being manufactured from woven strands;
 Figure 11 is a composite view of a two-
 25 part mandrel for the manufacture of T-
 tubes;
 Figure 12 shows the manner of winding
 a tape on the T-shaped mandrel of
 Figure 11;
 30 Figure 12a shows the completely wound
 strip on the T-mandrel;
 Referring now with particularity to the
 drawings, in Fig. 1 there is shown per-
 35 haps the most common type of tube or
 bobbin, to wit: a straight, hollow element
 of elongated nature, the dimensions of
 such an article being variable, of course,
 dependent upon the situation in which it
 40 is to be used. The words "tube" and
 "bobbin" are herein used interchange-
 ably as their difference relates only to
 45 dimensions. A short, stubby tube may
 be termed a bobbin.
 In Fig. 2, a modified form of tube is
 shown at 2 having a slightly depressed
 50 groove 3 at the end portion thereof. This
 form is particularly desirable in an end
 to end anastomosis in that it facilitates
 ligaturing the incised ends of the duct.
 The grooves 3 may be formed by pressing
 55 or moulding the material upon the form
 on which it is produced.
 In Fig. 3, a tube is shown at 4 having
 a collar 5 at one end which may be desir-
 able in some instances.
 60 In Fig. 4, the tube 4 is provided with
 collars 5 and 6 at each end.
 In Fig. 5, a spool shaped tube 7 is
 shown which involves all of the desirable
 65 attributes of the tube of Fig. 2 in that
 ligaturing is facilitated. This embodi-
 ment resembles the embodiment illus-
 trated in Figure 4 but differs therefrom
 in that the ends are smoothly flared out-
 wardly instead of meeting the body of the
 spool in abrupt edges as in the arrange-
 ment illustrated in the previous figure.
 The spool shape of the tube may be
 further accentuated into the form shown
 in Fig. 6 where at 8 the tube is di-conical
 in shape, that is, it consists essentially of
 70 two frusto-conical configurations with
 their smaller bases contiguous.
 In Figs. 7 and 7a, Y and T-shaped tubes
 are shown respectively.
 In manufacturing these shapes, any
 suitable absorbable animal tissue may be
 utilized which will have or can be made
 to have desirable rigidity, absorbability
 and freedom from a tendency to produce
 75 tissue irritation. The tissue must like-
 wise be capable of withstanding heat or
 chemical sterilization. The best material
 of which I am aware from which these
 tubes may be made is the submucous
 80 layer of animal intestinal tissue.
 This material in either the form of
 threads or ribbons may then be wound
 over a metal or other form to give it the
 desired shape. For instance, in Fig. 8 a
 85 ribbon 9 may be spirally wound over a
 metal form 10, slightly overlapping the
 convolutions, and the core 10 subse-
 quently removed after the ribbon has
 been permitted to assume a self-sustain-
 ing condition.
 In Fig. 9, threads 11 are spirally
 wound, woven or spun over the core 10 in
 the same manner as recited for that of
 Fig. 8. It has been found that in this
 90 type of manufacture, the contact of the
 threads with each other is sufficient to
 cause a coalescence therebetween with the
 result that an eventually integral con-
 struction results.
 95 In Fig. 10, a modified form of weaving
 is shown over the core 10, where these
 strands may be either in the form of
 threads or ribbons.
 Where Y or T-tubes are to be made, it
 100 will be desirable to provide a two-part
 core such, for instance, as is shown in
 Fig. 11. There one arm is shown at 12
 having a threaded socket 13 in which the
 leg 14 may be screwed. Obviously, where
 115 a Y-tube is desired instead of a T, one
 arm of the Y may be screw-connected to a
 member constituting the other arm and
 the leg of the Y. In manufacturing a T
 tube from the two-part core of Fig. 11,
 120 reference is had to Fig. 12 and 12a using
 preferably a ribbon material, such for
 instance, as is shown in Fig. 8. In this
 instance, the ribbon may be wound on the
 core beginning at one end of the arm,
 125 spirally around that arm from the end
 toward the center. At the center, it is
 criss-crossed down the leg 14 to the end,
 back again upon itself and out to the
 opposite end of the arm 12. Where
 130

desired, a second or any number of additional layers may be superimposed in the same manner and beginning at the opposite end of the arm 12. When the winding has been completed and the material is self-sustaining, the core may be disconnected by unscrewing the leg 14 from the arm 12 followed by subsequent removal of the latter. In the case of a 10 Y-tube, the member constituting the one arm and leg of the Y must be removed before the tube is completely rigid.

Obviously, absorbable straight, Y or T-tubes of animal tissue may be made also 15 by winding or spinning gut threads or narrow gut ribbons or strips spirally or transversely over a form and held together by a binder of glue or similar substance.

20 In all cases, it is desirable to form press the material of the tubes or bobbins to shape, either with or without heat, as this materially assists in bringing the tube to a self-sustaining condition with 25 smooth surfaces. This action, therefore, eliminates to a great extent the irregularities in the surface of the articles shown, for instance, in Figs. 8, 9, 10, 12 and 12a.

30 For the purpose of retarding absorption by animal tissue, the absorbable tubes may be further treated. The methods which I have devised for the purpose may consist of: 1) immersion of 35 the absorbable tube in a solution of formaldehyde; 2) immersion of the tube in a liquid petroleum product such as that on the market under the Registered Trade Mark "Albolene"; 3) coating the 40 tube with keratin; 4) coating the tube with paraffine; and 5) coating the tube with resinous material.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A device for use in surgery as an aid to anastomosis, or for drainage purposes 50 and the like, comprising a sterile tube constructed artificially from absorbable animal tissue.

2. A device for use in surgery, as for example, as an aid to anastomosis, or for drainage purposes and the like, comprising a sterile Y-tube constructed artificially from absorbable animal tissue, and adapted to be inserted into and left in the body to be absorbed thereby. 55

3. A device for use in surgery, as for example, as an aid to anastomosis, or for drainage purposes and the like, comprising a sterile T-tube constructed artificially from absorbable animal tissue, and adapted to be inserted into and left in the body to be absorbed thereby. 60

4. A method of making a tubular article for use in surgery which comprises applying absorbable animal tissue to a mandrel to form a tube, the mandrel 70 being removed when the tube becomes self-sustaining, and sterilizing the tube.

5. A method as claimed in claim 4, in which the animal tissue is form pressed on the mandrel before the latter is 75 removed.

6. A method of making a tubular article for use in surgery, which comprises winding animal tissue helically in one direction around a mandrel and then 80 back in a reverse direction, to form a tube, the mandrel being removed when the tube becomes self-sustaining, and sterilizing the tube.

7. The improved device for use in 85 surgery, substantially as hereinbefore described, with reference to the several embodiments illustrated in the accompanying drawings.

8. A method of making a tubular 90 article for use in surgery, substantially as hereinbefore described, with reference to the accompanying drawings, for the purpose specified.

Dated this 27th day of April, 1937.

For: DAVIS & GECK, INC.,
Stevens, Langner, Parry & Rollinson,
Chartered Patent Agents,
5—9, Quality Court, Chancery Lane,
London, W.C.2, and at
120, East 41st Street, New York,
U.S.A..

489,316 COMPLETE SPECIFICATION

SHEET 1

[This Drawing is a reproduction of the Original on a reduced scale.]

Fig. 1.

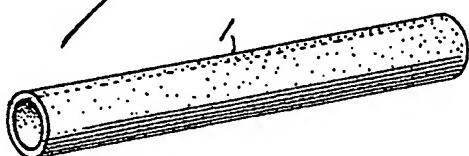


Fig. 2.

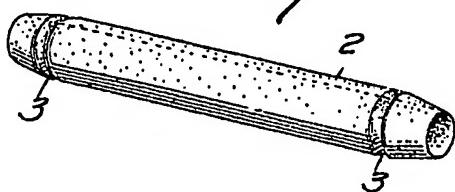


Fig. 3.

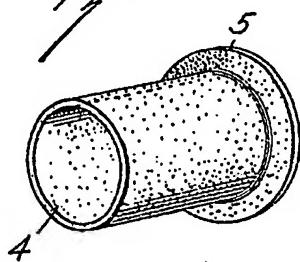


Fig. 4.

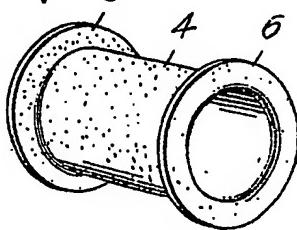


Fig. 5.

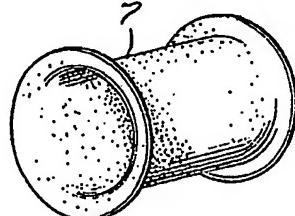


Fig. 6.

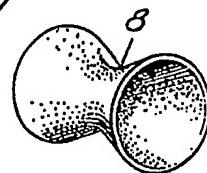


Fig. 7.

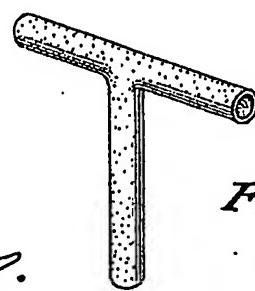
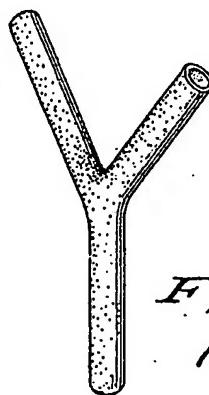


Fig. 7a



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FEET 1

